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Calculation and Analysis of Spare Parts Consumption for ISUZU SAZ LE-60 Buses

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Abstract: This article examines the issues of calculating and analyzing the expenses for spare parts of ISUZU SAZ LE-60 buses operated under the conditions of Uzbekistan. During the research process, the spare parts most frequently replaced during technical maintenance and routine repairs were identified, and the total cost was calculated based on their prices and service life. In addition, the specific consumption of spare parts was determined in relation to the buses' mileage, operating conditions, and maintenance intervals. Based on the obtained results, an equation for the specific consumption of spare parts was derived.

Keywords: ISUZU SAZ LE-60, spare parts, technical maintenance, routine repair, failure, operation, expenses.

Isuzu SAZ LE-60 avtobuslarining ehtiyot qismlar sarfini hisoblash va tahlil qilish

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Annotatsiya: Ushbu maqolada O'zbekiston sharoitida ekspluatatsiya qilinayotgan ISUZU SAZ LE-60 avtobuslarining ehtiyot qismlarga ketadigan sarf-xarajatlarini hisoblash va tahlil qilish masalalari yoritilgan. Tadqiqot jarayonida avtobuslarning



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texnik xizmat ko'rsatish va joriy ta'mirlash jarayonlarida eng ko'p almashtiriladigan ehtiyot qismlar aniqlanib, ularning narxi va ishlash muddati asosida umumiy sarf miqdori hisoblab chiqildi. Shuningdek, ehtiyot qismlar solishtirma sarfi avtobuslarning yurish masofasi, ekspluatatsiya sharoiti va xizmat ko'rsatish davriyligi bilan bog'liq holda aniqlandi. Olingan natijalar asosida ehtiyot qismlar solishtirma sarfi tenglamasi aniqlandi.

Kalit so'zlar: ISUZU SAZ LE-60, ehtiyot qismlar, texnik xizmat ko'rsatish, joriy ta'mirlash, buzilish, ekspluatatsiya, sarf-xarajat.

SAZ LE-60 avtobusi — bu past polli shahar avtobusi bo'lib, Isuzu kompaniyasi tomonidan ishlab chiqarilgan va 56 yo'lovchi sig'adigan hamda 25 o'rindiqa ega. Avtobus Isuzu 4HK1 dizel dvigateli bilan jihozlangan (190 ot kuchi, Euro-5). Tashqi o'lchamlari taxminan 8066×2466×2782 mm va to'liq massasi 10 200 kg bo'lib, shahar ichidagi yo'lovchi tashish uchun qulaylik va komfortni ta'minlaydi.

Ekspluatatsiya jarayonida avtobuslar bo'yicha solishtirma (so'm/ming km) ehtiyot qismlar sarfi ko'pincha ishlatiladi.

Avtobuslar foydalanishidan boshlab o'tgan masofasi oshgan sari, buzilishlar soni oshib boradi, bu esa joriy ta'mirlash ishlarini narxining oshishiga olib keladi. Masofa oraliqlari bo'yicha solishtirma ehtiyot qismlar sarfi o'zgarishi $C_{EQ}(L)$ daraja ko'rinishidagi tenglamada (1) aks ettirilgan:

$$C_{EQ} = B \cdot L^n, \quad (1)$$

bu yerda B – bosib o'tilgan masofaga qarab ehtiyot qismlarni solishtirma sarfining o'zgarishini aks ettiruvchi burchak koeffitsienti; n – bosib o'tilgan masofaga qarab ehtiyot qismlarni solishtirma sarfining o'zgarishini aks ettiruvchi daraja koeffitsienti.

Ushbu tenglamani yechish uchun eng kichik kvadratlar usuli qo'llaniladi. Eng kichik kvadratlar usuli eksperiment natijalari asosida olingan qiymatlari o'rtasidagi



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funksional bog'liqlik parametrlarining (tenglamaning argumentlari) aniqlash uchun ishlatiladi.

Tenglama bosqichma-bosqich yechiladi:

a) tenglamaning (2) ikkala qismi logariflanadi:

$$\text{Lg}(C_{EQ}(L)) = \text{Lg}(B) + n \cdot \text{Lg}(L), \quad (2)$$

b) o'zgaruvchilar almashtiriladi:

$$Z = \text{Lg}(C_{EQ}); \quad a_0 = \text{Lg}(B); \quad a_1 = n; \quad U = \text{Lg}(L)$$

Keyin tenglama to'g'ri chiziq shaklini oladi:

$$Z = a_0 + a_1 \cdot U, \quad (3)$$

Koeffitsient (a_0 va a_1) larni aniqlash uchun ularni yaqinlashuvchi funksiya sifatida to'g'ri chiziq tenglamasi (3) olinadi. Uholda:

$$S_k = \sum_{i=0}^m x_i^k \quad (k = 0, 1, 2, \dots, 2m), \quad (4)$$

$$V_k = \sum_{i=0}^n Y_i \cdot x_i^k, \quad (k = 0, 1, 2, \dots, m)$$

bu yerda k – tenglamadagi darajalar soni;

m – tenglamani daraja qiymati;

n – qo'shiladigan xadlar soni.

Agarda ($m = 1$) bo'lsa, unda to'g'ri chiziq tenglamasi bo'ladi, ya'ni

$$Y = a_0 + a_1 \cdot X, \quad (5)$$

U holda a_0 va a_1 koeffitsiyentlarini quyidagi formulalar bo'yicha aniqlanadi:

$$a_0 = \frac{S_2 \cdot V_0 - S_1 \cdot V_1}{S_2 \cdot S_0 - S_1^2}, \quad a_1 = \frac{-S_1 \cdot V_0 + S_0 \cdot V_1}{S_2 \cdot S_0 - S_1^2}, \quad (6)$$

Ekspulatatsiya jarayonida SAZ LE-60 avtobuslaridan nazorat ostiga olingan $N_0 = 48$ tasi bo'yicha aniqlangan ehtiyot qismlar sarfini tahlil asosida 1 ta avtobusga to'g'ri keladigan ehtiyot qismlar solishtirma sarfi 1-jadvalda keltirilgan

1-jadval

Dastlabki ma'lumotlar



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№ t/r	Masofa oraliqlari (ming km) bo'yicha				
	0-100	100-200	200-300	300-400	400-500
Oraliqlar o'rtasi, ming km	50	150	250	350	450
Ehtiyot qismlar solishtirma sarflari, mil.so'm/ming km	20240	64767	242876	538374	696244

Tenglamaning koeffitsiyentlarini aniqlash uchun MS Excel dasturidan foydalaniladi, 2-jadval statistik ma'lumotlar bo'yicha (1, 2, 7), ustunlar to'ldiriladi. $L = 0$ bo'lganda ehtiyot qismlar solishtirma sarfi qiymati $C_{EQ}(L) = 0$ bo'ladi. Biroq qiymat 0 bo'lsa uning logarifmini aniqlab bo'lmaydi. Shuning uchun $X > 0$ birga yaqin bo'lgan qiymat qabul qilinadi, u holda $X = 0,011$ va $Y = 1,1$ qabul qilingan.

2-jadval

Hisob natijalari

Masofa	Masofa oraliqlari	$U = \text{Log}(X)$	U^0	U^1	U^2	Solishtirma sarf-harajatlar,	$Z = \text{Log}(Y)$	$Z * U$	Nazariy qiymati, so' m/ming km
1	2	3	4	5	6	7	8	9	10
									67.61...1.48



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0	0,011	-1,96	1	- 3,96	15,67	0,0001	-4,00	15,83	0
0- 100	50	1,70	1,00	1,70	2,89	20240	4,31	7,32	22104
100- 200	150	2,18	1,00	2,18	4,74	64767	4,81	10,47	112361
200- 300	250	2,40	1,00	2,40	5,75	242876	5,39	12,91	239305
300- 400	350	2,54	1,00	2,54	6,47	538374	5,73	14,58	393750
400- 500	450	2,65	1,00	2,65	7,04	696244	5,84	15,50	571156
			6,00	7,51	42,55		22,08	76,62	
			S0	S1	S2		V0	V1	

Eslatma: MS Excel dastrida yechishda o'nlik logarifmi $Lg(x)$ $Log(x)$ sifatida yoziladi va har doim $x > 0$ bo'lishi kerak.

$$a_0 = \frac{42,55 \cdot 22,08 - 7,51 \cdot 76,62}{42,55 \cdot 6 - 7,51^2} = \frac{364,09}{198,9} = 1,83$$

$$a_1 = \frac{-7,51 \cdot 22,08 + 6 \cdot 76,62}{42,55 \cdot 6 - 7,51^2} = \frac{293,9}{198,9} = 1,48$$

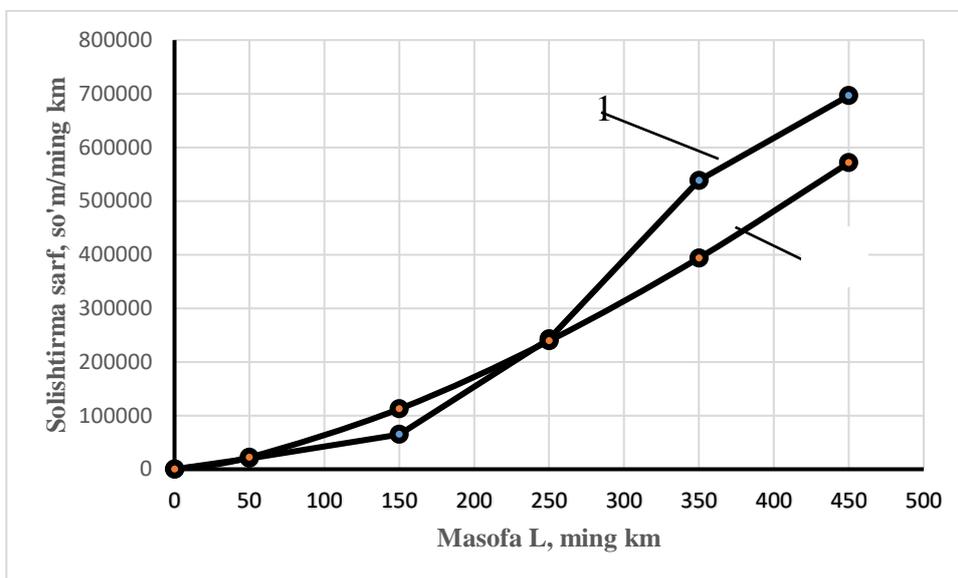
$$B = 10^{a_0} = 10^{1,83} = 67,61; n = a_1 = 1,48$$

U holda ehtiyot qismlarning solishtirma sarflari ISUZU SAZ LE-60 avtobusi bo'yicha quyidagicha bo'ladi $C_{EQ} = 67,61 \cdot L^{1,48}$



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1-rasm. Ehtiyot qismlarning solishtirma sarfini masofa bo'yicha o'zgarishi: 1-sinov bo'yicha; 2-nazariy.

Grafikdan ko'rish mumkinki masofa oshgan sari ehtiyot qismlar uchun ketadigan solishtirma sarfi oshib boradi. Ushbu solishtirma sarflarni kamaytirish uchun TXK va JT ishlarini o'z vaqtida va sifatli bajarish kerak.

XULOSA

Ekspulatsiya jarayonida SAZ LE-60 avtobuslaridan nazorat ostiga olingan $N_0 = 48$ tasi bo'yicha aniqlangan ehtiyot qismlarning solishtirma sarfini masofaga bog'liqlik asosida, uning tenglamasi anqilandi, ya'ni $C_{EQ} = 67,61 \cdot L^{1,48}$. Ushbu tenglama SAZ LE-60 avtobuslarini ishlash muddatini tadqiq etishda va ekspulatsion sarf-xarajatlarni aniqlashda qo'llaniladi.

Adabiyotlar ro'yxati:

1. A.A.Tojiboyev, Q.M.Sidiqnazarov, K.I. Ibrohimov, N.V. Kuznestov. "Ishonchlilik nazariyasi va diagnostika asoslari" Nashr. lits. AI 222. 16.11. 2015



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2. A.A. Tadjibaev , V.U. Jovliev , S.O. Narziev , I.T. Karimov. Determination of the gas reducer resource of gas cylinder buses. Fifteen International Conference on Thermal Engineering: Theory and Applications. May 28-June 1, 2024 Tashkent, Uzbekistan

3. Таджибаев А.А. Методология определения потребности в запасных частях для автомобилей. Вестник ТАДИ 3-4/2017. Стр.81-85.

4. Таджибаев А.А. Влияние ресурсов заменяемых деталей на надежность автомобилей в процессе эксплуатации. Вестник ТАДИ 1/2020. Стр. 3-9.

5. Tadjibayev A.A. Avtomobillarning ishonchliligini ekspluatatsiya jarayonida tadqiq etish. /monografiya/; -Toshkent: "Innovatsiya-Ziyo", 2022. 150 b.

